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DRY PLATE MAKING

FOR

AMATEURS.

A SERIES OF ARTICLES FIRST PUBLISHED IN THE
PHOTOGRAPHIC TIMES.

BY

GEORGE L. SINCLAIR, M.D.

(*With Additions and Corrections.*)

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PUBLISHERS' NOTICE.

The following practical instructions for dry plate making were written by Dr. Geo. L. Sinclair, an amateur photographer, with no thought that they would ever be published in a form more pretentious than as contributed articles to the photographic journal in which they first appeared; but the articles attracted to themselves more attention than the modest author would have predicted, and were read not only by the numerous readers of The Photographic Times, but by so many others, that our limited supply of the extra copies containing the articles being soon exhausted, we decided to republish them in pamphlet form.

The articles have been arranged in their present form by the editor of The Photographic Times with the suggestions and approval of the author.

They were originally written by Dr. Sinclair, in leisure moments, after professional labors, as the fruit of experiments which he had also made in otherwise unemployed hours. It does not pretend to be a scientific treatise, or anything more than a simple narration of experience; but as the outcome of practical experiment, the information given can be relied upon as trustworthy.

We, therefore, present this little book to the photographic fraternity with these few preliminary remarks, confident that it will fill a want in photographic literature.

INTRODUCTION.

In his work, "Modern Photography," Mr. W. K. Burton says: The amateur will generally find it best to purchase his plates from a manufacturer. He will probably find it cheaper and more satisfactory to do so than to manufacture them himself, unless he has at his disposal considerable time and has great patience and a happy temperament which will enable him to bear frequent disappointment, when, after going through the tedious process of making an emulsion and coating his plates, he finds that the latter are, through some unknown cause, useless.

With much of the above quotation I agree, but I have no hesitation in saying that the failures are much fewer than the successes, and the process of making an emulsion is not by any means the least interesting in connection with photography.

For the benefit of my brother amateurs who may feel inclined to try their skill in this department, I shall record my experiences, giving them the results of any knowledge I may have gained through my own failures.

G. L. S.

DRY PLATE MAKING FOR AMATEURS.

Published in the *Photographic Times*, Vol. XVI.
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THE EMULSION.

THE formulas for emulsions are numerous. I shall quote only two.

The first is for a slow emulsion of excellent quality, and is practically the one recommended by Mr. Debenham in his article in the *Photographic News*. The second I obtained from Wilson's "Mosaics" for 1885. It is rapid, and gives negatives which leave little to be desired so far as printing qualities are concerned.

If I appear too rudimentary it is because some of my readers may be novices in the work of emulsion making.

I am fortunate in having a bath-room provided with a basin as well as a tub, and a plentiful supply of both cold and hot water. It opens into a room which is unused in the evening.

I do my emulsion making at night; but some of the operations connected with it—for example, the washing—are occasionally performed by day, so I have made the door of the bath-room light tight.

My non-actinic illumination is by means of a ruby lantern. The apparatus required is of a very simple and primitive kind and consists, in addition to the graduates and scales—which I presume all amateurs have—of a tin kettle holding about two quarts (mine is narrower at the top than at the bottom, and has a spout closed by a tin flap), with a tight fitting cover. I have an ordinary retort stand, an alcohol lamp with a large wick, one or two common tumblers, and several perfectly clean *yellow* glass pyro bottles, and, lastly, one or two stirring rods of glass.

I may say that I have not been successful in the "cold emulsion process," and, for certainty, prefer either the "boiling" method or some modification of it.

I advise the beginner to try first the emulsion by the Debenham formula.

It is simply made, requires very little silver, no boiling, and possesses every good quality, except rapidity. For landscapes this is not very necessary. It is also cheap, and if one spoils a batch of plates the pecuniary loss is not great. The chemicals used should be pure, and the gelatines "photographic." The common cooking gelatine will not answer, or, at best, will give plates which are very defective.

To make an emulsion by this formula proceed as follows: Take of

Nelson's No. 1 gelatine	20 grains
Bromide of potassium	15 grains
Distilled water	¾ ounce

Put the gelatine in a glass and cover it with the water; allow it to soak for ten minutes, then add the bromide of potassium and stir till it is dissolved. Place the glass containing the bromized gelatine in a basin or dish capable of holding three quarts or a gallon of water, and pour into the basin water at a temperature of about 120 deg. F. If you have a bathroom with a fixed basin and hot and cold water, you can get along very nicely. Fit a cork to the outlet of the basin instead of an ordinary plug; through the cork pass a piece of brass tube about half an inch in diameter and four inches long. This gives you an overflow to your basin, and by pulling it up or down through the cork you can regulate the height to which you wish the water to rise. Having by some means surrounded your cup or glass containing the bromide, water and gelatine with warm water, allow it to remain until the gelatine is dissolved. This will not take many minutes. While this is going on, prepare, in a second glass (I use an ordinary 2 oz. graduate, as it has a spout for pouring), a solution of

Nitrate of silver (recrystallized)	20 grains.
Distilled water	1 ounce.

Dissolve by stirring with the glass rod; when solution is complete, put this glass also in the basin and raise the temperature to that of the bromized gelatine. When this is done, *in a dark room by ruby light*, pour, in five or six doses, the silver solution into the gelatine solution, stirring with a glass rod all the time. A change in the color is at once visible, caused by the formation of the yellow bromide of silver. When you have thoroughly mixed the two solutions—*and this must be done in the smallest quantity of non-actinic light by which you can see*—pour them into one of the pyro bottles, or into a stoneware opaque bottle of suitable size, and put the bottle or jug into water at a temperature of from 130 deg. to 160 deg. F. In my case I do this by merely turning on the hot water tap of my basin. I test the water with the thermometer and do not let it go higher than 160 deg. F. If possible, I keep it at this temperature for from two to three hours. With this formula you can let the heat vary from 120 deg. to 180 deg. F., without fear of injury. To keep it between these two extremes is not very difficult. If you have not fixed hot water apparatus, you can put your bottle or jar in the tin kettle which you have filled with hot water, and covered with the lid on the retort stand, then put your alcohol lamp under it and raise the temperature to the required degree. Or you (if you are using an opaque bottle for mixing your emulsion, such as a clean gingerbeer or ink jug) may put the kettle containing it upon the kitchen stove, and accomplish the same end.

It is well to have two stoppers for the bottle, one to fit tight and the other with grooves cut in the sides to allow the escape of steam from the emulsion.

In whatever way you select to get the emulsion raised to the desired temperature (120 deg. to 160 deg. F.), you must remember that it is to be kept at that heat until the blue stage is reached.

The "blue" stage is the sensitive stage, and is obtained in various ways in different formulas.

If, immediately after mixing your silver solution with your bromized gelatine, you take a drop of the emulsion, place it upon a piece of glass and look at a lamp light or gas light through it, you will see that the color is a red-orange. After being subjected to boiling, or to heat for a varying length of time, the color changes gradually until it becomes blue; when this is obtained the emulsion is done. In my experience with formula given, if I keep the bottle in water which is not below 130 deg. F. and not above 170 deg F., the blue color will appear in about two and a half hours.

It is well to remove the bottle from the hot water every half hour, take out the grooved cork, insert the tight fitting one, and shake the emulsion thoroughly for a few minutes. This seems to insure a finer subdivision of the particles and a better emulsion.

Half an hour before the cooking is finished you weigh out

Hard gelatine	70 grains.
Nelson's No. 1 gelatine	70 grains.

Put this in a cup or wide mouth bottle capable of holding eight ounces; pour upon it three ounces of cold water and allow it to soak. In half an hour the probability is that the water will nearly all be absorbed by the gelatine which will be considerably increased in bulk.

If your emulsion has by this time reached the blue stage, allow the water by which it is surrounded to cool down to 100 deg. F., and while this is taking place put the vessel containing the swelled gelatine in water at the same temperature (100 deg. F.), and allow the gelatine to slowly melt. When this is accomplished and the emulsion has cooled down to 100 deg. F., pour it upon the softened gelatine, stirring thoroughly, and then put the vessel in a dark, cool place and leave it until the contents have become cold, when it will have acquired the consistency of tough jelly. In other words the emulsion has "set."

This is a good point at which to stop. It becomes tedious to attempt the making and subsequent operations of washing, remelting and filtering the same night.

When Mr. Debenham published the formula, from which the above description is a departure in some particulars, he said the emulsion could be used without washing. So it can; but there is crystallization of some of the salts upon the glass, the drying is irregular and the emulsion is not at its best. Far better it is to wash it in the way I shall now describe.

WASHING.

The lump of emulsion which is the result of setting, contains not only the sensitive and insoluble bromide of silver, but also the insensitive and soluble nitrate and bromides. These must be removed. It can be done by washing.

Gelatine holds these soluble salts very tightly in its grasp, and to remove them thoroughly it is necessary to break the jelly up into small pieces so that the water may penetrate them and dissolve the salts.

There are several ways of subdividing the gelatine, but the simplest and best is to squeeze the jelly through the meshes of embroidery canvas. Procure a piece of canvas known as "railway canvas," about eighteen inches square. You can buy it at a shop dealing in worsteds, etc. You must first thoroughly soak it in boiling water to remove the size and starch; then dry it again. I have two common water jugs with mouths wide enough to admit my two hands. They hold a gallon of water each. I have also a hair sieve seven inches in diameter, the use of which I shall explain further on.

When you are ready to wash the emulsion, you again go to the dark room, light your ruby lamp, and with a silver or horn spoon remove the jelly from the vessel in which it has been allowed to set or stiffen. Place it in the center of the square of canvas, gather the canvas up by the four corners, then holding the neck with the left hand, grasp the lump of emulsion with the right, plunge both hands into the jug containing water at a temperature of about 40 deg. F., and twist the canvas till the jelly is forced through the meshes into the water.

It will then be broken into small shreds, which will speedily settle to the bottom of the jug. This material is now to be washed.

I find that by allowing it to settle, then stirring it about with a clean hand, again permitting it to settle, then pouring off the clear water and pouring on fresh, and continuing this for twenty minutes and then pouring the whole into the hair sieve and doucing this with several jugfulls of cold water, the washing is complete. To make the washing more thorough you may again collect the shreds and squeeze them a second time through the canvas. I think it would be safer to do this, though such has not always been my practice.

Let the broken-up mass remain in the hair sieve; which can stand on its edge in a basin to allow draining to take place. In an hour the water will have so far passed through the sieve that the consistency of the emulsion is about that of butter. It must now be melted and strained to remove any mechanical impurities.

MELTING.

To melt it, you remove it from the sieve with a horn or silver spoon and put it into a cup or jar (I use a gallipot with a cover) which is placed in water at about 100 deg. or 120 deg. Fahrenheit. When it is about the consistency of thick milk it is ready for straining. To accomplish this I have an ordinary lamp chimney of the pattern in which the upper edge is turned partly over and fluted or scalloped. Over this end I fasten two thicknesses of an old handkerchief, and having previously warmed the extemporized filter, pour the melted emulsion into it. It runs through the handkerchief readily, and if it shows any tendency to stop running, by placing the mouth over the open end of the chimney and blowing with some force, you can drive it with greater rapidity. When all has passed through, into a convenient vessel (I use a pyro bottle for this) you should have about six or seven ounces of emulsion. If less, make it up to that quantity by the addition of warm water.

Finally, add one-half ounce of warm alcohol and your emulsion is ready to be poured on the plate.

You may, if you please, again put the vessel aside in a dark cool place to wait until you can proceed to the coating of your plates. If you do not intend using it for some days, it will be well to add some antiseptic. Thymol is very good, and two grains dissolved in the alcohol above mentioned will keep the emulsion from spoiling for a long time.

I have gone somewhat fully into the *modus operandi*, because it is the same, so far as washing, melting, filtering, etc., is concerned in all formulas.

A RAPID EMULSION.

The emulsion, the making of which I have attempted to describe, as I said, is slow.

For a more rapid, and in every way an excellent one, I give, from "Mosaics," the following modified recipe and description :

Nelson's No. 1 gelatine	80 grains
Bromide of potassium (Schering's)	164 grains
Iodide of potassium "	20 grains
Water (filtered)	5 ounces.

First dissolve the salts and then add the gelatine, and set the vessel containing the solution in hot water (temperature, 120 deg. F.).

Weigh out 232 grains nitrate of silver (recrystallized), put in a bottle ; a pyro bottle or an opaque jug. Now heat both the vessel containing the bromized gelatine and the bottle containing the nitrate of silver to a temperature of about 140 deg. F., by any convenient means ; carry them into your dark room, in which your kettle or saucepan or vessel in which you propose to boil your emulsion, has been filled with water at a boiling temperature, and in a weak ruby light pour in a stream the bromized gelatine upon the dry, hot crystals of nitrate of silver. Insert the tight-fitting stopper and shake vigorously till the silver crystals are dissolved. You can generally tell this by the sound of their striking the bottle ceasing.

Then place the emulsion in the kettle of boiling water ; having previously removed the tight cork and inserted the grooved one. Cover the kettle tightly, place your alcohol lamp under it and let the water and the emulsion boil briskly for half an hour. If boiled longer than this add one or two drops of nitric acid.

To insure the contents of the bottle or jar being at the same temperature as the water, in which it is suspended, it is necessary to completely surround it. I do this by swinging the bottle in the water, so that it does not touch the kettle at either bottom or sides. I take a piece of brass wire, about No. 12, and encircle the neck of the bottle; by a twist this is secured. The free ends I bend like a hook, which I hang upon the side of the kettle. This vessel being narrower at the top than the bottom, the bottle falls away from its side and remains suspended in the boiling water. The small size of the wire used does not prevent your fitting the cover over the kettle securely.

The flame of an alcohol lamp can, I believe, be made non-actinic by adding a little common salt to the alcohol itself. Every ten minutes I remove the lamp from the room, uncover the kettle, take out the bottle of emulsion and again putting in the tight stopper, shake the bottle for a few seconds, then replace it again in the kettle, cover it, and bring the alcohol lamp back to the dark room, put it under the kettle and again boil the water.

I have never had fog in this emulsion, and I have made several batches just as I have endeavored to describe above.

As soon as you have mixed your emulsion and started the cooking, you again return to your outside room and weigh out

Hard gelatine..	180 grains
Soft gelatine..............................	.100 grains,

Put this in a cup and pour on a sufficient quantity of cold water to cover it. Let it soak during the boiling of the emulsion, say for half an hour. At the expiration of that time, remove your alcohol lamp, and leaving your bottle of emulsion in the kettle let its contents gradually cool.

While this is going on place the cup containing the softened gelatine in water at about 100 deg. F., and allow it to melt.

By the time this is complete the temperature of the emulsion will have probably reached the same figure; when it has, pour it upon the softened melted gelatine, and stir thoroughly, till perfectly mixed, with a silver fork or spoon. Finally add to this, with much stirring, one dram of strong water of ammonia, and shake well. Then remove the emulsion to a cool, dark place and allow it to set. Again, it is well to break off operations here.

GELATINE.

In both the latter and Debenham's formula, I used a mixture of hard and soft gelatine in that portion which is added after the cooking.

If you use only hard, as the original recipes suggest, you get a plate with a hard glossy film which is not so easily penetrated by the developer.

To the use of this mixed gelatine, and also to the necessity of adding the emulsion to the uncooked gelatine at a temperature of about 95 deg. F., I believe is due the "mat" surface which is thought best in a dry plate.

The author of this recipe claims that it owes its excellence and rapidity to the fact that he adds his bromized gelatine at a temperature of 140 deg. F., to dry silver crystals of the same degree of heat. At any rate, it is an excellent emulsion. Plates coated with it will be quick enough for drop shutter views.

I do not recommend the same method of mixing in Debenham's formula. I have failed in that emulsion to obtain any increase of speed, either by prolonging the cooking, adding the silver dry, or converting its solution into an ammonio-nitrate. Nor does rapidity ensue by keeping the emulsion some days before coating. In the "Mosaics" formula it does to a slight extent.

The details of washing, filtering, etc., need not be again gone into as they are the same as in the first formula given.

When all this has been done you should have about sixteen ounces of emulsion. If not, make that amount by adding water. To this quantity you add an ounce and a half of alcohol, warmed, before beginning to coat your plates. It is said to make the emulsion " flow " more easily.

A fault which some emulsions have, is a tendency to frill during development. I have not had this to contend with since I have used Heinrich's hard gelatine and Nelson's No. 1 photographic (soft) gelatine.

If your gelatine is of a frilling kind, either discard it or add to the emulsion, just before beginning to coat your plates, a solution of chrome alum, one-half grain dissolved in one dram of water to each ounce of emulsion. All the emulsion so treated must be used at once, as it will not remelt after once setting.

PREPARING THE GLASS FOR COATING.

Having brought your emulsion to the stage described above, it is ready to be spread upon the glass plate. We take it for granted you propose to coat glass and not paper. And here let me say a word as to the preparation of the glass itself. It is probable that you will make use of spoilt negatives, either your own or some that you obtain from friends. I get all I require from a professional photographer.

To clean the old negatives, dissolve several ounces of common washing soda in two or three gallons of hot water. In this solution place the negatives and leave them, for, say, twenty-four hours. At the end of that time you will probably find many of the films have disappeared, those which still adhere to the glass can be very easily removed by using an old tooth brush as a rubber. After the glasses are denuded of their old films, put them into hot water, to which add a small quantity of hydrochloric acid; let them soak for an hour then transfer them to pure hot water for another hour, after which they will be clean and may be reared up on end to drain and dry.

When ready to coat plates, select the number of glasses of the size you propose to use and polish them with a piece of soft chamois skin.

In my limited experience I have not found any substratum required upon the glass. If I did use one, it would be a weak solution of water glass, which is generally recommended in the books.

We will suppose you have cleaned a sufficient number of glasses for the emulsion you have on hand, you will then require a place in which to do the coating and the apparatus for it.

In my own case, I perform the operation in the unused room which, as I said, communicates with my dark (bath) room. There is no reason why the dark room itself should not be made use of if it is large enough.

You require first of all a perfectly level surface on which you are to place the coated plates to "set." I have a piece of plate glass 3 feet long and 18 inches wide, and by means of wedges and a spirit level, I accurately level this upon a table. If you cannot get a piece of glass or slate of sufficient size, you can obtain a piece of board, and by putting screws into it so as to form triangles large enough to support the plate you propose to coat, by driving the screws further in or withdrawing them, you can, with the board on a flat table, accurately level each plate.

You also require a vessel for your emulsion, from which it may be poured. The books say a small china tea-pot is good. I have a "feeding cup" with a long spout. It holds about 4 ounces, and answers admirably. Then a glass rod for spreading the emulsion over the plate is desirable. Finally, to dry your plates, you need some light-tight box or cupboard which, if it can be arranged to let a current of air through, will be all that you require.

I have dried plates in an ordinary box to which I fitted a light-tight cover, and in which I nailed strips to keep the plates from slipping, leaving space on the bottom in which to put a saucer containing chloride of calcium, which absorbed the water given off by the emulsion in process of drying. Your own ingenuity will enable you to prepare some proper receptacle.

COATING.

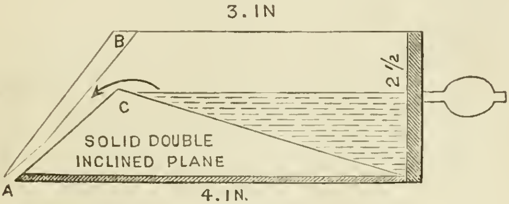
For coating, after trying many methods, I have settled upon the plan of spreading the emulsion upon each plate separately, by means of a glass rod, the plate having first been put upon a little elevated platform on the corner of my plate glass level surface.

Of course you coat at night by the faintest ruby light. When ready for the operation I select an hour in the evening when the house is quiet. My glass having been made level, I put the ruby light in a paper box, about one foot high and eight inches wide, one side of which has been removed, and a piece of oiled yellow tissue paper pasted in its stead.

The box containing the cleaned glass which I wish to coat is in front of me, to my right, the lamp is to the left. On the left upper corner of the plate glass, just under the lamp, I have a little tripod made by gluing strips of glass on another piece, size, 4x5; upon the tripod I lay the plate (we will say it is $4\frac{1}{4}$x$3\frac{1}{4}$). The emulsion having been melted by placing the bottle in water at 120 deg. F., a sufficient quantity, say 2 ounces, is poured into the "feeding cup." This amount should cover twelve quarter plates; about a teaspoonful is poured on to the center of the plate, the glass rod is taken between the thumb and forefinger of each hand, brought down in contact with the pool of emulsion, but not so as to touch the glass (which immediately runs to either lateral margin of the plate), and rapidly moved first forward, then backward, to the edge of the plate, and at each end removed by simply twirling it a little. It is hard to describe this movement in words.

It is very simple and easily acquired. The ball of the index finger resting on the plate glass beneath, gives you a support, and it is surprising how evenly and rapidly you can slide the glass rod back and forth, and spread the emulsion over the plate.

You place the coated plate on the level surface, when in a short time it will "set," and may be removed to your drying receptacle and placed in an upright position if necessary, with no danger of the emulsion running off. You go on until you have used up the amount of emulsion in your cup. As I said, the 2 ounces should cover a dozen 4¼x3¼ plates, half that number of 4¼x6½, and six or eight 5x4. It is desirable that the temperature of your coating room be not higher than 60 deg F., though it is an advantage to have your plates warmer than that in order to let the emulsion "flow" more rapidly.



It is also well to have at hand a vessel of hot water in which you can place your coating pot, to keep its contents warm, after pouring the emulsion on the plate, and while you are spreading it by means of the rod. In my own practice I have adopted the above mode of working after trying several other plans.

For instance, you may cover a plate by "flowing" it with emulsion as you would varnish. An amateur friend of mine always adopts this method; with me it will not work. Or you may use a "coating box" of some description.

For plates up to 4¼x6½, I prefer the rod and "feeding cup;" for larger sizes I have manufactured a box of this shape. The illustration on preceding page may make it clear. As I have it, it is only a change in shape of one recommended some time ago by a writer in the *Photographic Journal*, of London.

The illustration represents a sectional view of the box. The outlet A is made by putting a piece of card between the two pieces B and C while the box is being screwed together. The slit thus left is covered when using by a piece of thin cheese-cloth glued on. This filters the emulsion as it runs out and delivers it more regularly. The box is exactly 5 inches wide, is made of walnut coated inside with copal varnish. You pour your emulsion into it, then by tilting it by its handle the liquid runs over the inclined plane down to the opening and upon the plate.

By having a number of plates on the levelled surface you can run the box along and cover them very rapidly. There is a tendency on the part of the emulsion not only to cover the top of the plate where you desire it to go, but to run over the edge and find its way beneath the plate, which it glues strongly to your level slap. To overcome this it is well to stretch across the leveling slab at proper intervals—say 3 inches—fine wire. I use a piece of rabbit wire. I secure each bit by its right end to a double-pointed tack driven into the table. I draw it tight across the surface of the slab and fasten the left end to a screw eye also fixed in the table. I can keep the wire taut by a turn of the screw eye, and as it is in close contact with the level slab it practically makes a platform running the length of the slab. If a little of the emulsion runs off your plate it can run under it without causing its lower surface to become fixed to the leveling slab. You thus avoid getting emulsion on both sides of your plate. I generally use up the 2 ounces of emulsion which I poured into the cup by covering plate after plate. By the time the last is coated the first has set, and may be taken from the slab and placed in whatever apparatus you have prepared for use as a drying closet.

In my box, drying is complete in about twelve hours. I leave the plates, though for 24 hours—the following night.

This year I have packed many of my plates without any form of mat, film to film. I put them up in bundles of four, wrap each bundle in yellow paper, and then wrapping three bundles in brown manilla, put the package containing a dozen plates in an old box of proper size and label it thus: "Debenham's F. 1 doz. 3¼x4¼. Feb. '86."

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